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A TREATISE ON CHEMISTRY.

A Treatise on Chemistry. By Sir H. E. Roscoe, F.R.S., and C. Schorlemmer, F.R.S. Vol. ii., The Metals. New edition, completely revised by Sir H. E. Roscoe and Dr A. Harden. Pp. xvi+1436. (London: Macmillan and Co., Ltd., 1907.) Price 30s net.

SIR HENRY ROSCOE is to be congratulated on having completed a new edition of that portion of Roscoe and Schorlemmer's well-known "Treatise on Chemistry" which deals with the metals. In the first edition the metals were described in several separate parts, which are now included in the present stout volume of more than 1400 pages, forming the second volume of the new edition of the "Treatise." The characteristics of this treatise are well known to English chemists. It constitutes a half-way house between a complete *catalogue raisonné* of chemical facts and principles of which Gmelin's handbook is the last great example and the modern dictionary and treatise in which only important facts are recorded, and then in the briefest possible manner, historical allusions being either altogether omitted or reduced to their simplest terms.

The present volume presents an orderly and readable account of the metals and their compounds, due regard being paid to the history of their discovery. The volume opens with a general discussion of the metals, which might with advantage be expanded. Then follow clear accounts of the methods used in the determination of atomic and molecular weights, of valency, including a brief description of Werner's view of valency, of the classification of the elements, in connection with which it may be noticed that the system of classification adopted in the volume is that of groups of natural families, which is undoubtedly still the most convenient for the purposes of description—and description is the key-note of the present treatise. Atomic weights are given both in relation to hydrogen and to oxygen as unity. The physical properties of metals and the constitution of salts follow next, and here it is interesting to notice that electrolytic dissociation is accepted without comment, although little use is made of the hypothesis throughout the book, and the older type of chemical equation is preserved. No fewer than thirty-four pages are devoted to spectrum analysis, a section which might well be considerably condensed. More than forty pages are given to crystallography, another special subject of great importance. In view of the unwieldy size of the present volume, it is a question whether both these special subjects should not receive less detailed treatment in a treatise on the metals. The remainder of the volume relates to the description of the metals and their compounds, to which 1177 pages are devoted.

It must be confessed that, without changing the readable type in which the book is printed, and without omitting the historical notices and descriptions of metallurgical and manufacturing processes

which form the most valuable feature of the "Treatise," there is room for very considerable condensation both in form and substance. Critical revision, both from a literary and a chemical standpoint, would lead to many changes for the better, and a reduction of the volume to nearly half its present dimensions without at all impairing its value. Nearly five pages are devoted to gunpowder of the old type, with voluminous tables relating to explosive processes and products, taken from the work of Noble and Abel of thirty-five years ago. Several pages are given to a description of processes of preparing alum which have long since been abandoned, yet in this account there is no allusion to the industry which once flourished on the Yorkshire coast, although alum manufacture in Italy and Asia Minor is mentioned. It would be easy to multiply instances of this kind and to point out many cases in which the exercise of a more critical judgment would have been beneficial, not only in eliminating unessential or unimportant material, but also in restricting a too luxurious licence in the use of words.

The historical information included in the volume is generally of great interest to the chemist as well as to the less technical reader, but here again much is recorded which is of doubtful value. The derivation of magnetite from Magnesia, a town in Lydia now known as Manisa, is at least plausible, but to urge in its support that Plato and Theophrastus called the mineral the "Heraclean stone," Heraclea being another name for Magnesia, is not likely to commend itself to anyone with knowledge of the subject. Magnetite is common throughout this country. Heraclea was probably a different town from Magnesia, and magnetite was probably found near both. One turns with interest to magnesium and manganese for information as to the origin of these words and their connection with magnetite, but the subject is left in confusion. It is a curious coincidence, if nothing more, and one of interest to the philologist, that the soil in the neighbourhood of Magnesia is particularly rich in the earth of that name.

The statement that "an alcoholic solution of ferric chloride was formerly employed as a quack medicine of repute, known by the name of Lamotte's golden drops," might well have been supplemented by the information that this solution is included in the British Pharmacopœia, and is still well known as "tincture of steel."

By far the most valuable sections of the book for the chemist will be the descriptions of modern metallurgical and manufacturing processes, which have been brought well up to date. More attention might have been given to the revision of the paragraphs relating to the occurrence of metals. The new source of tin in the highlands of West Africa, from which an appreciable output of the metal is already being obtained and which promises to have a great future, is not alluded to; whilst the occurrence of tungsten as wolframite with the tin ore of the Malay States is not mentioned under tungsten, although the separation of tungsten from tin is alluded to in connection with the metallurgy of tin.

The metallurgy of iron and steel is well described, but the discussions of the constitution of steel and of the rusting of iron leave much to be desired.

With all its imperfections, the "Treatise" is of great interest and value. As has been said, its strength lies in its descriptions of facts, which are usually accurate and clear. Criticism and generalisation are both weak points in the work. The chemist will, however, be thankful for a generally readable account of the subject, and even grateful to the author, who has not been deterred from his task by the appalling number and complexity of the facts of chemistry, a circumstance which is chiefly responsible for the calamity that the most notable treatise on chemistry written in English in recent times, notable alike for its grasp of detail, its power of generalisation, and not least for its extraordinary clearness in brief description, never got beyond that first volume, which astonished the chemical world nearly half a century ago.

PRACTICAL PHYSICS.

Practical Physics: a Laboratory Manual for Colleges and Technical Schools. By W. S. Franklin, C. M. Crawford, and Barry MacNutt. Vol. i., Precise Measurements. Measurements in Mechanics and Heat. Pp. vii+173. Price 5s. net. Vol. ii., Elementary and Advanced Measurements i. Electricity and Magnetism. Pp. vii+160. Price 5s. net. Vol. iii., Photometry. Experiments in Light and Sound. Pp. vii+80. Price 4s. net. (New York : The Macmillan Co.; London : Macmillan and Co., Ltd., 1908.)

THIRTY years ago Prof. E. C. Pickering published his "Physical Manipulation." The whole aim of the book, he told his readers, was to show how work in the physical laboratory might be made to teach a student to think for himself and to investigate; and in order to aid the instructor in the cultivation of originality he added to the 200 experiments described a hundred experimental problems as suggestions of what the student might with advantage be set to do.

In the book before us Pickering's aim has been completely lost sight of. The authors regard a laboratory course for undergraduates as

"having a two-fold purpose. On the one hand it serves to illustrate the principles of physics and their application to actual problems. . . . On the other hand it is intended to cultivate the power of accurate observation, to familiarise the student with methods of measurement, to give him skill and facility in the use of measuring instruments, and to develop in him the judgment necessary for the making of measurements in a manner adequate to the requirements of science, engineering and commercial work."

The character of the book is in close accord with the authors' conception of the educational utility of a laboratory course.

(1) The discussions by which most of the experimental exercises are introduced, while sufficient possibly for the objects in view, are in general quite insufficient to give the student an intelligent command of the methods involved. He is

accordingly assumed not to have acquired it. There is some discussion, e.g., of the balance and the barometer, and of the corrections which observations made with them may require, but the student is not trusted, in exercises in which these instruments are used, to settle the question of corrections for himself. He is told whether or not he is to apply any, and if any, which.

(2) The student is encouraged to make unintelligent use of formulæ. For example, he is given the expressions for the probable errors of an average and of a single observation, with a statement of their significance so short as to have a probable error of its own, and he is then directed in exercise after exercise to compute their values. He is not expected, apparently, to make any use of the results of his computations.

(3) Correct procedure being essential to the acquisition of skill in measuring, the student gets full directions as to what he is to do. Thus in the case of the Kelvin double bridge there is no general discussion of the arrangement, but a cut of a particular form of the bridge is given, and the student is even told to which binding-posts he must connect the terminals of his resistances and his galvanometer. The directions are not so detailed as this in all cases; but the course to be taken is in general fully pointed out.

(4) The student is in no case set to the serious investigation, or even testing, of physical laws. Perhaps the nearest approach to work of this kind is the study of the compressibility of air, and the following is a slightly condensed extract from the directions to the student:—

"Tabulate the values of $v(b \pm h)$ along with the values of v and $(b \pm h)$ —the positive or negative sign to be used according as the pressure of the entrapped air is greater or less than the pressure of the outside air. Determine the mean of the tabulated values of $v(b \pm h)$, and tabulate the differences between this mean and each of the tabulated values of $v(b \pm h)$. These differences represent errors of observations. Plot the pairs of values of v and $b \pm h$, using values of v as abscissas and values of $b \pm h$ as ordinates, and draw a smooth curve among the points so plotted."

There is little scope for the student's initiative here.

As to extent, the book contains 132 selected experiments. It does not claim to be exhaustive. In the selection the needs of the technical student have been kept in view, and the advanced electricity and the photometry are especially technical in their character. Among somewhat unusual things which are included are the Venturi water-meter, flash-point determinations, decomposition voltages, mean horizontal candle-power, and integrating photometry. Among important things omitted are thermoelectric and resistance thermometry, ice and steam calorimetry, quadrant electrometers, differential galvanometers, Newton's rings, and cardinal points of lens systems.

The book has minor defects due to insufficient editing of the laboratory direction papers on which it appears to have been based. There are dreary repetitions of similar, sometimes identical, directions. Unusual terms such as abampere are employed without definition. There are references to "the instructor" which should have been replaced by references to